TDRS KSAR Upgrade Project (TKUP)

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Introduction

- GSFC/Code 450, Code 452 and NASA Headquarters management met on March 1, 2004 to reassess the Ka-Band Data Services (KaDS) Project and the Ka-Band Flight Systems (KaFS) Project
- Both the KaDS and KaFS projects were discontinued
- Direction was given to formulate and present to management for approval a new project providing a data service for the 225 MHz channels using bandwidth efficient modulation and coding schemes
- Direction was also given to explore potential synergy with replacement of the existing 225 MHz channel data service equipment due to obsolescence
- TKUP was proposed to management and approved in July 2004.

Current SN Situation

- Maximum coded KSA Return data rate is 150 Mbps
- Maximum uncoded KSA Return data rate is 300 Mbps
  - Increases customer EIRP requirement by more than 5 dB
- The SN is not compatible with Col-T and JEM
  - ISS desires to use these Ka-Band systems as backup in case of a Ku-Band antenna system failure
- Large expenditures will be required in the future for SN equipment obsolescence avoidance
  - KSA High Rate (Loral) Equipment and High Rate Switches (Harris)
    - **Projecting impacts to operations beginning ~2008 due to equipment failure and inability to repair**
  - Cost of addressing obsolescence is dependent upon the approach
  - Original Loral Costs: $32.4M (6/92 estimate, no software costs)
  - Original Harris Costs: $7.2M (6/92 estimate, no software costs)

TKUP Top-Level Requirements

- Enhance the TDRSS KSA 225 MHz Return data service by adding the capability to process bandwidth efficient signal designs
  - Potential requirements (per recent modulation and coding study)
    - OQPSK/TPC or LDPC - 150 Mbps to 410 Mbps
    - 8PSK/TPC or LDPC - 410 Mbps to 625 Mbps
- Provide Single Access Antenna Autotrack for new signal designs
- Enhance the KSAR service by adding the capability to process Col-T and JEM signal designs
  - QPSK modulation (SN currently supports OQPSK)
  - No stacking of convolutional encoder/decoders
- Replace Equipment nearing obsolescence
  - KSAR High Rate Equipment and High Rate Switches
- Potentially provide one-way and/or two-way Doppler tracking for new signal designs
  - Need to develop the operations concept to establish requirement

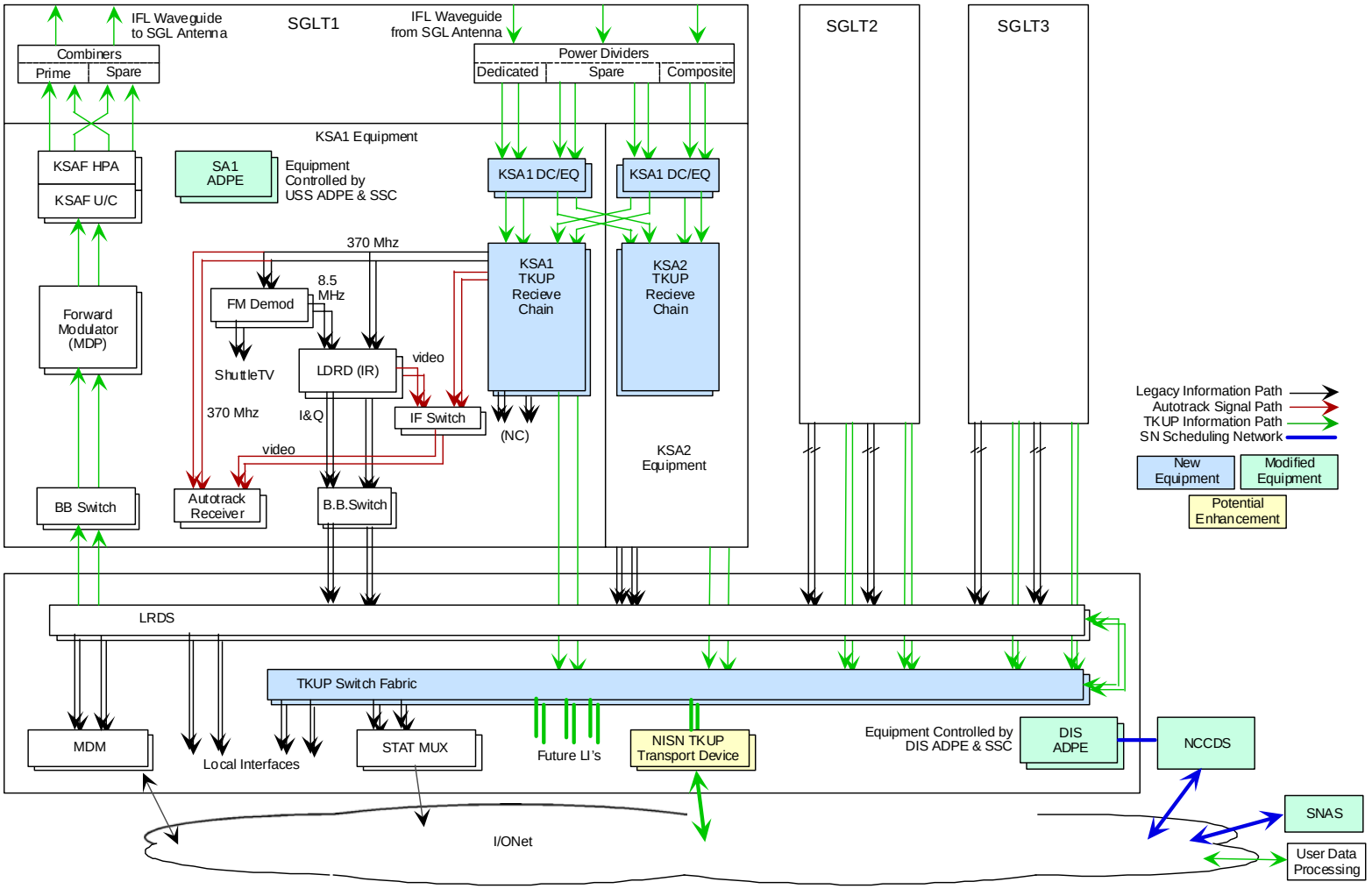
Items Not Proposed for TKUP

- 16QAM/TPC or LDPC - 625 Mbps to 825 Mbps
  - New signal designs without 16 QAM have lower technical risk
  - Existing EET HPAs adequate for new signal designs without 16 QAM
- Ka-band end-to-end test capability
  - No Ka-Band customers on the horizon
  - Adds significant cost

Follow-on Needs (Not Part of TKUP)

- Follow-on Items will be worked with new customers as they are identified
  - Compatibility Testing
    - Potential approaches include
      - Test via TDRS using rooftop antenna at vendor site
      - Test using spare receiver in the CTV
      - Provide a full equipment suite for the CTV
  - Flight Hardware
    - Potential area of partnering with customers
  - Data Interfaces
    - NISN or Local Interface

Proposed TKUP Architecture



Proposed TKUP Schedule

ID	Task Name	Duration
1	**Project Formulaion**	**35 da**
2	Obtain Management Approva	7 da
3	Develop PCD and PMP, Tasl	28 da
4	**Requirements Development**	**141 da**
5	Develop Architecture	120 da
6	Develop Operations Concept	120 da
7	Develop System Requiremer	120 da
8	System Requirements Revie	0 da
9	Demonstration	0 da
10	**Design**	**389 da**
11	System Design	357 da
12	Preliminary Design Review	0 da
13	Critical Design Review	0 da
14	Implementation	479 da
15	First article reciever on si	0 day
16	Test	261 da
17	Documentation and Training Co	0 da
18	Operations Readiness Review	0 da
19	Unplanned work (contingency)	87 day